Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Promoting Investment in the 3550-3700 MHz Band;	)	GN Docket No. 17-258
	)	
	)	
Petitions for Rulemaking Regarding the Citizens Broadband Radio Service	)	RM-11788 (Terminated)
	)	RM-11789 (Terminated)

To: Chief, Wireless Telecommunications Bureau
Chief, Office of Engineering and Technology

COMMENTS OF ELMA AVDIC, IRENE MACALUSO AND LINDA DOYLE

Elma Avdic
Irene Macaluso
Linda Doyle
CONNECT Centre
Dunlop Oriel House
Trinity College Dublin
The University of Dublin
Dublin, Ireland

November 23rd, 2017

TABLE OF CONTENTS

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Promoting Investment in the 3550-3700 MHz Band;	)	GN Docket No. 17-258
	)	
	)	
Petitions for Rulemaking Regarding the Citizens Broadband Radio Service	)	RM-11788 (Terminated)
	)	RM-11789 (Terminated)

To: Chief, Wireless Telecommunications Bureau
Chief, Office of Engineering and Technology

COMMENTS OF ELMA AVDIC, IRENE MACALUSO AND LINDA DOYLE

My name is Elma Avdic, I am a PhD researcher at CONNECT, Centre for Future Networks & Communications, Trinity College Dublin, University of Dublin, Ireland. My supervisor Prof. Linda Doyle and co-supervisor Dr Irene Macaluso and I respectfully submit these comments in the above-mentioned proceeding as our research focuses on ways to utilise spectrum more efficiently, to share more extensively and in a dynamic manner. These comments reflect our views alone and not those of the Centre or any other party.

EXECUTIVE SUMMARY

The Commission should firmly reject the petitions of T-Mobile and CTIA on the basis of not providing any new arguments that have not been raised before, which do not further pursue constructive discussions to fully unlock the potential of 3.5GHz sharing framework, as envisioned by the PCAST report. Furthermore, the arguments that reopened this case have already been thoroughly addressed and extensive discussions that the FCC had with the stakeholders community throughout the framework process design fruitfully resulted in the final adopted rules, the step which snowballed the process of standardization, SAS certification, creation of CBRS Alliance etc., all of which prepared this band close to rollout.

The only new 'argument' raised in the petitions for rulemaking of the 3.5GHz band were the 5G concerns of big carriers which cannot be grounded in any way in the FCC goals from the beginning - introducing more competition, innovation and new players, which is what 5G is about.

The comments presented here are a general argument that applies to all the points raised in this new request for consultation. However, we specifically focused on the point of a license term and license area because the licensing model is the core element of the three-tier sharing framework.

I. 5G MOTIVES, BUT 4G THINKING

While the claims of aiming to maintain leadership in the 5G race sound progressive and optimistic, one cannot ignore the conservative and innovation-lacking voices raised in the 3.5GHz proceedings.

The whole point of 5G is diverse usage in the bands, wide area of new technologies and new services, new vibrant equipment markets and the most use cases are about densification and more localised spectrum usage[1]. The opinions stated in the proceeding are completely opposite to this very idea and defy the nature of 3.5 GHz as a small cells band. There are those who read 5G as a continuation of 4G. The long-term, large area licenses that are also renewable create a sense of entitlement to these bands on the part of those who read the terminology in that way.

After tens of thousands of hours invested into development, design, and discussions the FCC re-opens the discussion with a single new argument embodied in 'the 5G concerns' which are in turn inspired by a petition from the two 4G-driven players. This framework was supposed to be the manifestation of 5G spirit, but at this point it turns to our biggest fear, 4G continuing into the next decade under the flag of 5G with all the limitations of 4G thinking and reasoning. The 3.5GHz band was already fully aligned with 5G thinking and attempt to 'fix it' is a step back. With the only new argument being an old one about worldwide harmonisation and identification of this band for 5G globally, which CBRS framework does not exclude at all, this attempt to hold

[1] *See* e.g. Bhushan, N., Li, J., Malladi, D., Gilmore, R., Brenner, D., Damnjanovic, A., Sukhavasi, R., Patel, C. and Geirhofer, S., 2014. Network densification: the dominant theme for wireless evolution into 5G. IEEE Communications Magazine, 52(2), pp.82-89., Boccardi, F., Heath, R.W., Lozano, A., Marzetta, T.L. and Popovski, P., 2014. Five disruptive technology directions for 5G. IEEE Communications Magazine, 52(2), pp.74-80., and Chin, W.H., Fan, Z. and Haines, R., 2014. Emerging technologies and research challenges for 5G wireless networks. IEEE Wireless Communications, 21(2), pp.106-112.

back the one truly innovative and progressive spectrum sharing framework lacks support in facts and in ideas alike. As originally regulated and designed, this framework reflected exactly that: nothing in the current rules of the CBRS sharing is an obstacle to harmonisation (considering the trade-offs that are offered for all of the players in this band), nor the changes the petitioners are proposing improve the harmonisation. This turn of events resembles the licensing freeze of the eighties as if the legacy ghosts of the past are still haunting us.

Conflicting policies argument in two adjacent bands (3.5 and 3.7 GHz) does not stand.[2] The adoption of CBRS rules for 3.7 GHz band is even easier than in 3.5 GHz band because of the static (and predictable) incumbent usage in the band. This is actually an opportunity to work towards multi-band adoption of innovative sharing framework designed in the CBRS rules and avoid having conflicting policies in two adjacent bands. It is one of the visions of the PCAST report which addressed the problem of legacy: dissecting and heavily fragmenting the bands. We cannot resist the conclusion that the big carriers are selling the 5G story, for their own interest only.

II. LICENSING SCHEME ISSUES

A. LICENSE TERM AND RENEWABILITY

It is time that this interest and business models that enable them are re-examined and questioned from the regulatory side because they only reflect the mindset of a traditional licensed carrier enjoying the privilege to spectrum bands. It, in fact, means that they are not incentivised to invest and upgrade their networks given the long-term and renewable licenses. Shorter term and non-renewable licenses would actually mean that they would be deploying new technologies faster because it would be easier once the culture of dynamic sharing is fully embraced, because market would be pushing it and they would be incentivised to do so. Those would be the rules of the game, if not playing the game, the operator would not be competitive. Otherwise, 10-15 year licenses create huge time constants in the system and do not encourage the operators to innovate in the band. One license would last as much as a generation in telecommunications and hence impede the development. Sharing perspective brings overall larger return on investment over a long period as the more vibrant and dynamic market hosting auctions every 3 (6 in case of one-time renewal) years enables more chance than the one-time returns of long-term, 10-15 year auctions.

The argument of Nokia[3] about the temporal overhead is not valid either, as the standardisation and prototyping are well underway in this band (besides, Nokia is already doing a CBRS small cells demo with Comcast and T-Mobile[4]). Even if it were true, the transition costs would only

[2] *See Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, GN Docket No. 17-183, Notice of Inquiry, 32 FCC Rcd 6373 (2017) (Mid-Band Spectrum NOI), T-Mobile Reply Comments and Petition of CTIA for Rulemaking to Amend the Commission's Rule Regarding the Citizens Broadband Radio Service in the 3550-3700 MHz Band

[3] *See* Nokia Comments at 4. (arguing that it takes "several quarters to standardize a new frequency band, another year to develop infrastructure equipment and certify it, and over a year to deploy a network" making the non-renewable three-year term a barrier to investment).

[4] *See* Nokia apparently demonstrating CBRS small cells for Comcast (Sean Kinney, Aug 14, 2017), available at https://www.rcrwireless.com/20170814/carriers/nokia-demonstrating-cbrs-small-cells-comcast-tag17 (last accessed Nov 23, 2017) and T-Mobile looks to test CBRS with Ericsson, Nokia (Sean Kinney, Sep 21, 2017), available at

(continued….)

happen in the first year of the framework implementation. Later, the return on investment would become a part of the routine. The year of growing period has almost passed and giving up at this point does not mean stopping in place, but going backwards and nullifying all these efforts.

The issues that the CTIA lists[5] arguing that interference protection guarantee is a necessary incentive for investment existed in the adoption stage of Wi-Fi as well, but it did not stop the deployment of millions of access points and fast proliferation of the compliant hardware. At the same time, acting on these "concerns" actively inhibits GAAs.

Longer term license does not facilitate deployment of wide area technologies. Market assessment based on historical data and experiences with old technologies is inadequate in the context of 3.5 GHz band as the Innovation Band is supposed to revolutionise the market, change the timescales in it and offer an environment for significant advancements rolling out instantaneously. The carriers will have to adjust their market models instead of trying to adjust the market.

Physics and the nature of 3.5 GHz band and the incumbents in it make this band the site of intensive spectrum reuse. The frequencies above the 3GHz threshold are not ideal for typical cellular licensed carrier anyway. These dynamic needs for more localised and time responsive coverage ask for short-term licenses as we increase both the spatial and temporal resolution in answer to the actual demand. The position of big carriers does not match two known facts: 1) the licenses are renewable, offering them 6 years to operate and bring in their revenue from a location 2) the licensing question has been extensively discussed, and the FCC made the decision going in their favour with offering 3-year, once renewable licenses. However, the reality of the situation is the need for the big carriers to consider the GAA option in their business models. Once they adapt the models to be flexible and inclusive with respect to actual regulations from the FCC, they will see the incentives they allegedly lack and in return bring more revenue while optimising spectrum usage.

If the argument of necessity of a big carrier to have a long term and renewable license is taken into consideration, then the three-tier model is effectively reduced to a two-tier ASA/LSA industry favourite. This model offers spectrum leasing under the name of spectrum sharing. ASA/LSA scheme is a way for traditional licensed carriers to get additional spectrum when the incumbent is not using it, but this type of sharing is fully controlled within the network operator domain. This would scale down the three-tier sharing model in the 70MHz portion of the spectrum (the band plan has been again raised as an issue by the petitioners as well) in which GAA operators basically could not deploy at all. This is important because the very idea of coexistence of diverse spectrum access tiers is then not implemented in the band at all.

B. GEOGRAPHIC LICENSE AREA

The petitions re-opened the discussion about the size of license area as well. This discussion ended up being framed in three options: 1) leave the Census Tract (CT) area unit, 2) Adopt

(Continued from previous page)
https://www.rcrwireless.com/20170921/carriers/t-mobile-test-cbrs-ericsson-nokia-tag17 (last accessed Nov 23, 2017)

[5] *See* CTIA Petition at 6 and other supporters: T-Mobile Petition at 12, Ericsson Comments at 10, USCC Comments at 7

Partial Economic Areas (PEA) as a basic licensing unit, or 3) Adopt hybrid approach (CTs in rural and PEAs in urban areas).

The ideal of license area design should be an area of minimal size which is at the same time **usable by an operator acquiring a single location for the focused localised service** they aim to provide and **by a bigger carrier aggregating several of these licenses**. While some census tracts do not fulfil the usability criterion, PEAs do not fulfill the minimality criterion which is another founding principle of this framework.

In 2016, we conducted an analysis of the census tracts of three highly dense urban areas – Washington DC, Manhattan and San Francisco – using the metrics of area loss percentage and number of people with access to spectrum, under the technical conditions for the 3.5GHz band and under the assumption that each census tract is licensed to a different PA user[6]. During this work, FCC issued the revision of the framework which we included in the analysis as the epilogue. The changes around the adoption of protection area were not sufficient because the percentage of census tracts for which the default protection area covers entirely the census tract was 99%, 97% and 92% for Manhattan, San Francisco and DC respectively.

Despite the above considerations, we believe that the CT is the best option among the ones considered. The combined increase of the license area and term would inevitably result in a higher cost of the license, effectively excluding new players from the market. Under the current rules, with a properly designed auction mechanism and given the possibility of aggregating multiple census tracts, each player will be able to bid for the license area they require to provide a service to their users. This means that the improvement of the licensing scheme based on census tract license area units would need to rely on more realistic models of demand, based on the field data. Some of the possible players have access to real traffic data[7] that will facilitate them in selecting the census tracts they require. If PEAs are the optimal license areas, it will emerge from a market-based mechanism. Adopting the CTs as a license area does not imply that big carriers will not be able to get a license that covers a PEA. Vice-versa, adopting the PEAs as a license area *does* imply that it will not be possible for smaller players to obtain a license in the PAL market. There is no guarantee that PA licenses will implement disaggregation and partitioning of the license area on the secondary markets and therefore it is uncertain whether small players would be able to obtain protected access in targeted areas.

Amongst the other arguments of the 'petitioners' on rulemaking, we give a brief note regarding the claims that the SAS would not be able to manage and coordinate 74,000 of potential census tract licenses. According to the conditionally certified SAS providers, Google and Sony, management of that number of licenses by the SAS is not an issue. Enforcement and cybersecurity protections, in particular, have been considered from the start for the SAS database systems based on cloud-computing principles, along with the dynamic reassignments, ways of authorisation, interference management and coordination. The FCC decided to leave these

[6] *See* Avdic, E., Macaluso, I., Marchetti, N. and Doyle, L., 2016, December. Census Tract License Areas: Disincentive for Sharing the 3.5 GHz band?. In Global Communications Conference (GLOBECOM), 2016 IEEE (pp. 1-7). IEEE. Available at http://ieeexplore.ieee.org/abstract/document/7841653/

[7] *See* Google collects Android users' locations even when location services are disabled (Keith Collins, Nov 21, 2017), available at https://qz.com/1131515/google-collects-android-users-locations-even-when-location-services-are-disabled/ (last accessed on Nov 23, 2017)

concerns to be addressed by the stakeholders, particularly those interested to act as the SAS providers, under the rules obliging them to act in discretion with respect to revealing CBSD deployment data. This way, the FCC opened an opportunity for the SAS providers to compete on the SAS market as well, one of the many markets under the CBRS umbrella.

III. CONCLUSION

Accepting the big carriers' point of view on the issues of the licensing scheme (term, renewability and license area) that are being re-addressed by these petitions after they have already been elaborated and extensively discussed throughout the framework design process, inevitably leads to:

1) Reducing three-tier to two-tier model in the 70MHz portion of the band if all suggestions are accepted;
2) Restricting GAA deployments, another founding component of the three-tier model;
3) Completely discrediting the role of the SAS, again a founding point of the model;
4) Destroying the very notion of dynamic spectrum sharing;
5) Impeding the innovation;
6) Annihilating competition from the start solely by the regulatory rules design;
7) Effectively making this band just another traditionally licensed band for big carriers.

There was room for improvement of the existing rules, continuing on the progressive path of modifying rules and making changes and listening to all of the stakeholders. That would have been the way to go and would be well accepted by the stakeholders as well as academia doing research in dynamic spectrum sharing. However, the actions taken now are just unbelievably retrograde. Instead of following the idea of constant dialogue and forward-going rulemaking which was fast, effective and good, bringing old issues together with same old arguments in a stage where the involved enterprises have already endeavoured in investment and planning has actively betrayed the principles of innovative regulation.